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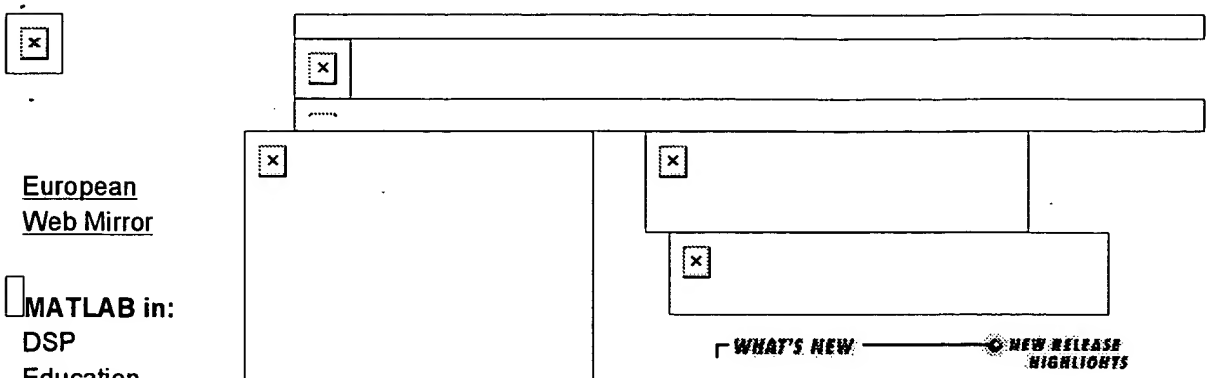

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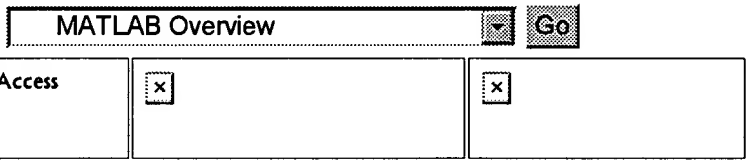

MATLAB

Mathematical Computation | Graphics & Visualization | Data Analysis | Algorithm Development | Simulation & Modeling | Programming & Application Development | DSP Design

MATLAB 5.0, 5.1 & 5.2 Highlights

DEMOS

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The Language of Technical Computing

MATLAB is an integrated technical computing environment that combines numeric computation, advanced graphics and visualization, and a high-level programming language.

Whatever the objective - an algorithm, analysis, graph, report, or simulation - MATLAB gets you there. The flexible, interactive MATLAB language lets engineers and scientists express their technical ideas simply. The extensive and powerful numeric computing methods and graphics allows testing and exploring alternative ideas easily, while the integrated development environment makes it easy to produce fast, practical results.

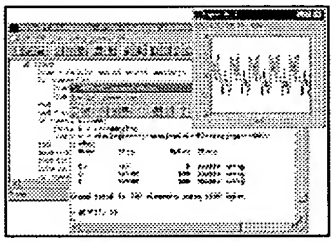
> *"For the purposes of an engineer or scientist, MATLAB has the most features and is the best developed program in its class."*
> *-IEEE Spectrum, Software Review, February 1997*

Background and Overview

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state of the art in software for matrix computation. Today MATLAB is used in a variety of application areas including signal and image processing, control system design, financial engineering, and medical research. The open architecture makes it easy to use MATLAB and companion products to explore data and create custom tools that provide early insights and competitive advantages.

The MATLAB Product Family includes tools for:

- Data analysis and visualization
- Numeric and symbolic computation
- Engineering and scientific graphics
- Modeling, simulation, and prototyping
- Programming, application development, and GUI design
- Converting MATLAB programs automatically to standalone C and C++ code



The MATLAB Command Window

What are Toolboxes?

MATLAB also features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment in order to solve particular classes of problems. Researched and developed by experts in their fields, toolboxes let you learn, apply, and compare best-of-class techniques, allowing you to evaluate different approaches without writing the code.

Areas in which toolboxes are available include signal processing, control systems design, dynamic systems simulation, systems identification, neural networks, and others.

Extensible and Portable Design

Probably the most important feature of MATLAB is its easy extensibility. This allows you to become a contributing author too, creating your own applications. It enables you to solve many numerical problems in a fraction of the time that it would take to write a program in a language such as Fortran, C, or C++. You can also link to external software and data from MATLAB. MATLAB code and data formats are platform independent, so sharing your ideas and designs across PC, Unix, and Macintosh platforms is seamless.

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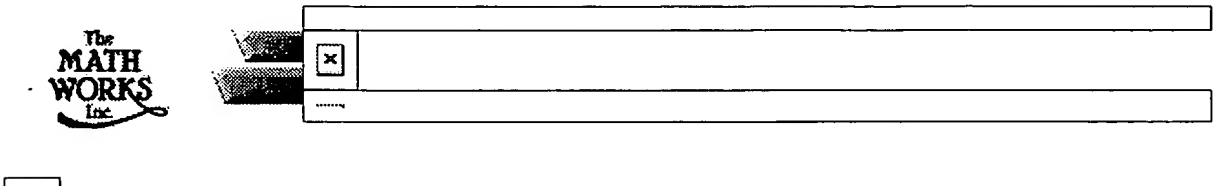

Toolboxes are specialized collections of M-files (MATLAB language programs) built specifically for solving particular classes of problems.

Our Toolboxes are more than just collections of useful functions, though. They represent the efforts of some of the world's top researchers in fields such as controls, signal processing, system identification, and others.

- Chemometrics
- Communications
- Control System
- Financial Toolbox
- Frequency Domain System Identification
- Fuzzy Logic
- Higher-Order Spectral Analysis
- Image Processing
- LMI Control
- Mapping
- Model Predictive Control
- μ-Analysis and Synthesis
- NAG
- Neural Network
- Optimization
- Partial Differential Equation
- QFT Control Design
- Robust Control
- Signal Processing
- Spline
- Statistics
- Symbolic/Extended Symbolic Math
- System Identification
- Wavelet

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Mapping

Statistics Toolbox

Powerful tools for statistical analysis and modeling.

Key Features
Overview
Functions
Examples
Requirements

The Statistics Toolbox is an easy-to-use environment for analyzing historical data, modeling systems to predict their behavior, developing statistical algorithms, and learning and teaching statistics. Interactive GUI tools let you apply statistical methods easily and consistently, while the MATLAB language lets you easily create custom statistical methods and analyses. This combination gives you the freedom to access functions such as probability and ANOVA directly from the command line, or to use the interactive interfaces to learn and experiment with the Toolbox's built-in visualization and analysis tools.

The Statistics Toolbox contains more than 200 M-files that cover the following areas:

- Probability distributions
- Parameter estimations
- Multivariate statistics
- Linear and nonlinear modeling
- Statistical plotting
- Statistical Process Control
- Design of Experiments

> ***"Ease of use is what draws me to MATLAB. The graphics are excellent and easy to produce."***
>
> **-Michael B. Miller, Washington University School of Medicine**

Key Features

- Interactive GUI tools that let you analyze data in real time
- Presentation-quality graphing tools for box plots, normal probability plots, contour plots, and more
- Modeling and surface fitting functions include:
  - Polynomial prediction with confidence intervals
  - Multiple linear regression

  - Ridge regression
  - Response surface visualization
  - Nonlinear least-squares fitting
  - Hypothesis testing functions such as one-way and two-way analysis of variance (ANOVA), one- and two-sample T-tests, and Z-tests
- Probability distribution functions
- Parameter estimates and fitting
- Principal Components Analysis (PCA)
- Statistical Process Control (SPC)
- Design Of Experiments (DOE)
- Descriptive statistics functions such as bootstrap statistics, results based on data with missing values, (NaNs), and percentile estimates
- Nonlinear model fitting and prediction
- Response surface modeling
- Interactive stepwise regression
- Curve fitting

Overview

Model Fitting Environment The toolbox is the ideal environment for non-routine model fitting. Primary capabilities include: regression analysis and diagnostics with variable selection, nonlinear modeling, probability modeling and parameter estimation, sensitivity analysis using random number generators, statistical process control, and design of experiments.

Probability Distributions The Statistics Toolbox supports a suite of 20 different probability distributions, including T, F, and Chi-square distributions. Parameter fitting functions, graphical displays of the fits, and ways to calculate better fits are provided for all distribution types.

GUI Tools Many interactive tools are provided for dynamic visualization and analysis of data. Specialized interfaces are included for response surface modeling, distribution visualization, random number generation, and contour plots.

Statistical Plots Statistical plotting commands such as `weibplot` and `randplot` allow you to perform reliability analysis or distributional fitting.

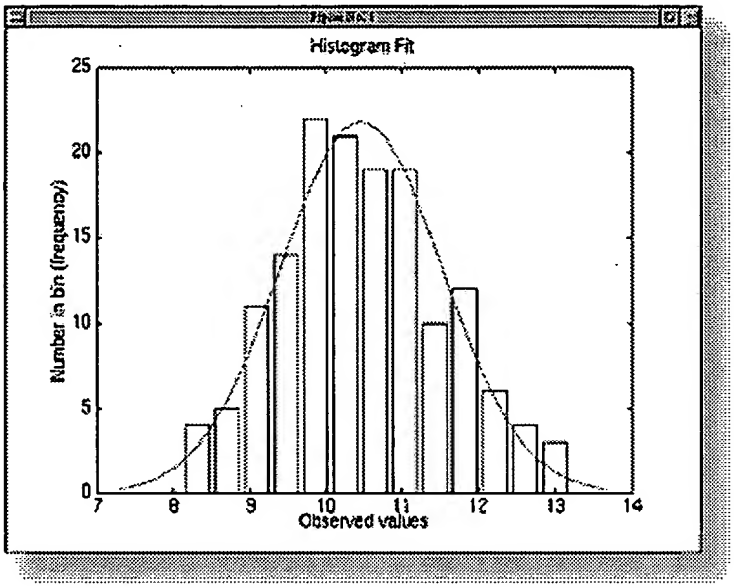
Design of Experiments (DOE) This lets you optimize a system's outputs by systematically varying its controllable inputs. The Toolbox supports D-optimal, factorial, and Hadamard designs. These techniques enable you to generate experimental designs for a wide range of process control and other applications.

Algorithm Development In conjunction with the MATLAB computing language, the toolbox gives you everything you need to develop new algorithms for statistical analysis. You can use the plotting functions in the Statistics Toolbox, or create your own using the Handle Graphics features in MATLAB.

NEW! Statistics Toolbox Functions

A full list of the Statistics Toolbox Functions are now available.

Examples



Above, the `histfit` command superimposes a normal density curve on a histogram. The default number of bins is set to the square root of the number of elements in the data.

Requirements

- ***Product Requirements.*** To use the Statistics Toolbox you will need MATLAB.
- ***System Requirements***
- ***Update Information***

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Optimization

PDE

Simulink

Spline

Stateflow

Statistics

Symbolic Math

NEW VERSION

Financial Toolbox 1.1

The Financial Toolbox is a robust set of functions essential to financial quantitative analysis and application development. The Toolbox provides a foundation within MATLAB for performing many types of financial tasks from simple calculations to development of full-scale distributed applications.

- Key Features
- Overview
- What's New
- Functions
- Demos
- Requirements

The Financial Toolbox is used for a wide array of applications including fixed income pricing, yield, and sensitivity analysis; advanced term structure analysis; coupon cash flow date and accrued interest analysis; and derivative pricing and sensitivity analysis. For more information see our MATLAB in Financial Engineering Web site.

Key Features

The Financial Toolbox provides advanced functionality in several areas, including:

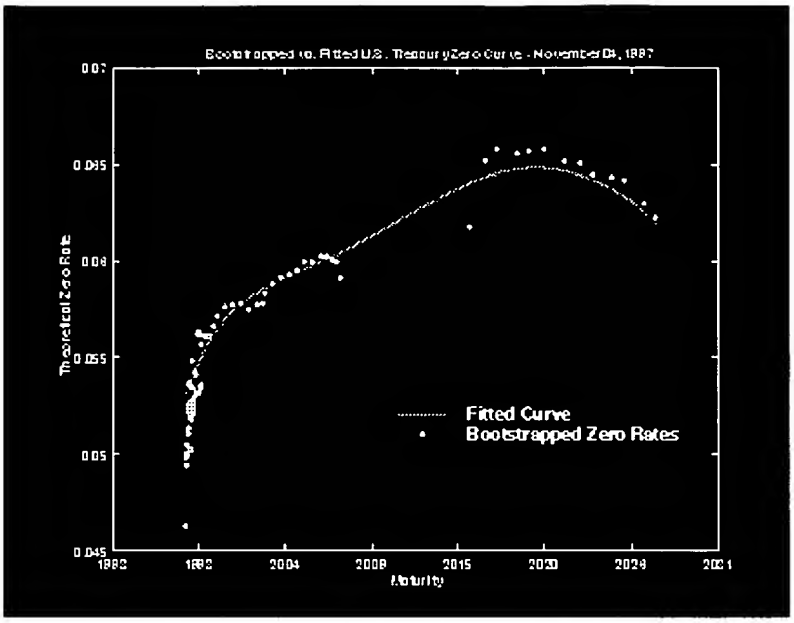
- Fixed income pricing, yield, and sensitivity calculations
- Advanced analysis on of the term structure of interest rates
- Advanced coupon cash flow date and accrued interest analysis
- Binomial lattice and Black Scholes-based derivative analysis
- Portfolio optimization and performance analysis
- Advanced financial date derivation based on major market conventions

Overview

Advanced term structure analysis. The Financial Toolbox contains an entire tool kit for advanced term structure modeling and analysis.

System Identification

Wavelet



The term structure toolkit contained in the Financial Toolbox lets you bootstrap a theoretical spot curve from U.S. Treasury market data and then convert that curve to its equivalent implied forward rate, discount, and par yield form.

Fixed income pricing, yield, and sensitivity analysis. The Financial Toolbox contains functions for computing prices, yields, and sensitivity measures for fixed income securities. The first or last period of the maturity cycle can be irregular and can differ from the interval between coupon dates. All major market conventions for bond basis and the "end of month rule" are specified within these functions.

Coupon cash flow date and accrued interest analysis for fixed income securities. Several functions are provided for precisely determining the coupon cash flow date structure and accrued interest amounts for a single fixed income security or an entire portfolio of securities.

Binomial lattice and Black Scholes-based derivative analysis. Functions based on both the Black-Scholes and binomial lattice option pricing models are provided. Functions that use the Black-Scholes framework to derive option sensitivity measures are also included.

Portfolio optimization and performance analysis. Functions are provided for determining the minimum variance asset allocation for a portfolio using an underlying Markowitz model to determine the efficient frontier. A function for deriving an exponentially-weighted covariance matrix based on asset returns is also provided.

Financial date derivation* based on *all major market conventions. Several functions are provided for deriving financial date structures *based* on differing market conventions. These include functions for:

- Identifying standard U.S. holidays
- Identifying user-specified holidays

- Finding the number of business days between dates
- Finding the first and last business days of each month
- Moving backward and forward by a specified number of days or months

What's New in Version 1.1

- Interest rate term structure suite
- Bootstrapping techniques
- Term structure smoothing function
- Utilities for converting market data to required formats
- Portfolio optimization covariance and constraint functions
- Black's option pricing model
- Fixed income/cash flow date functions

Update Information

Demos

Advanced Term Structure Analysis

NEW! Financial Toolbox Functions

A full list of the Financial Toolbox Functions is now available.

Requirements

- ***Product Requirements.*** To use the Financial Toolbox you will need the Statistics Toolbox and the Optimization Toolbox. The Simulink graphical interface is recommended for Monte Carlo and non-stochastic simulations for pricing fixed income, derivative, and equity instruments. The Spline Toolbox is also recommended for those wanting to fit curves to financial market data.
- ***System Requirements***

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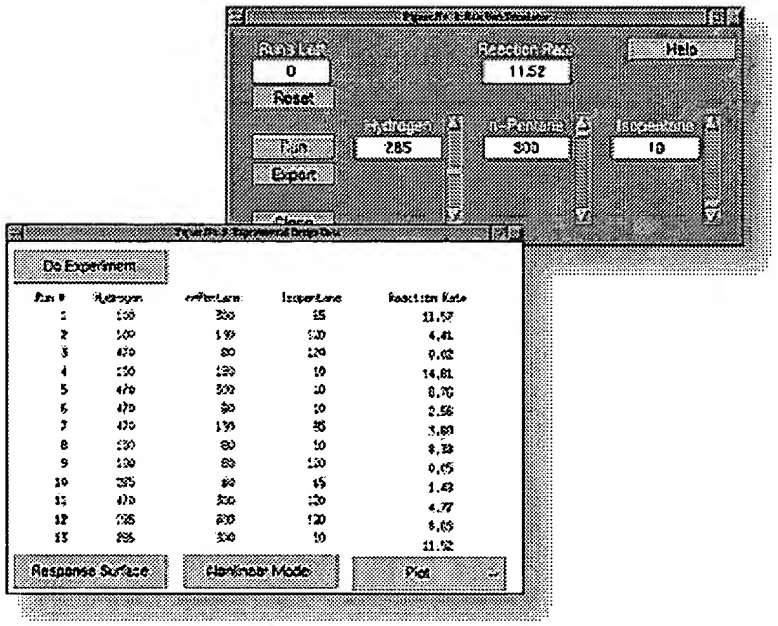
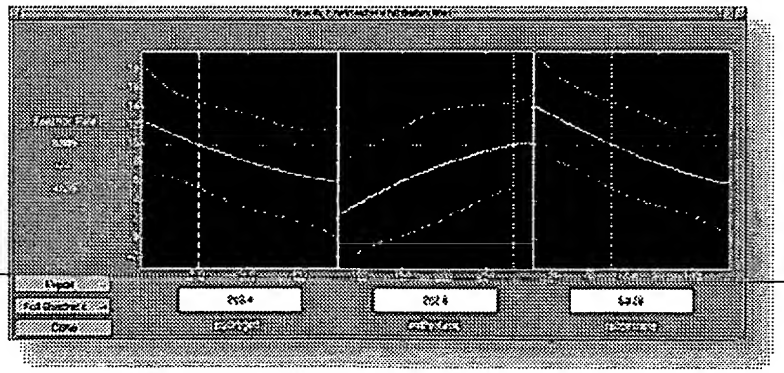
Exploring and Learning with the Statistics Toolbox GUI Tools

The Statistics Toolbox includes a number of easy-to-use displays that provide graphical views of your data and precise numeric readouts of the current function value and related descriptive statistics. User interface controls, such as buttons, sliders, and dynamic data curves, give you control over the data display.

These interactive displays allow you to explore your data, experiment with changes to inputs, and view the results of hypothetical changes — all in a single screen. This approach to statistics helps you learn about a process while giving you an intuitive feel for the behavior of the underlying statistical functions.



The Statistics Toolbox features interactive displays that let you experiment with and learn about the toolbox's built-in visualization and analysis tools. The interactive tool shown above, obtained by typing `rsmdemo`*, teaches concepts in design of experiments and regression modeling.*



Multiple input displays allow you to do multidimensional relationship analysis. Each section represents one input. The dotted cross bars can be moved with the mouse to change one parameter value, which causes all other parameters (inputs) to update simultaneously.